

CLAIMS

1. A multi-stage electric pump unit, of those that consist of a multi-stage centrifugal pump with an electric motor coupled directly to the pump, where each stage consists of a pump, an impeller and a diffuser, which each have channels with vaned and vaneless zones. These zones are delimited by a shroud-surface and a hub-surface, where the β angle is the angle of the tangent at each point, characterised because, given that the Y-axis of the electric pump is the radial co-ordinate and X is the axial co-ordinate, for flow rates, Q, between 2500 and 8000 litres/minute, the points of the impeller and diffuser surface comply with the sixth degree polynomial equation, $Y = f(x) = Ax^6 + Bx^5 + Cx^4 + Dx^3 + Ex^2 + Fx + G$, where on the diffuser:

a) on the hub, the vaneless zone; $A=B=C=D=E=0$; $F=0.6605$; $G=20.45$;

b) on the shroud, the vaneless zone; $A=B=C=D=E=0$; $F=0.7225$; $G=55.648$

c) on the hub, the vaned zone; $A=-9E-09$; $B=7E-06$; $C=-0.0019$; $D=0.3064$; $E=-26.923$; $F=1256.3$; $G=-24283$

d) on the shroud, the vaned zone; $A=1E-10$; $B=-9E-08$; $C=2E-05$; $D=-0.0033$; $E=0.2349$; $F=-7.616$; $G=174.28$

e) on the hub, the vaneless zone; $A=0$; $B=0$; $C=-1E-05$; $D=0.0073$; $E=-1.7542$; $F=186.27$; $G=-7311.6$;

f) on the shroud, the vaneless zone; $A=0$; $B=0$; $C=0$; $D=0.0053$; $E=-2.6745$; $F=446.37$; $-G=24717$;

g) on the hub, β ; $A=0$; $B=0$; $C=1E-06$; $D=-0.0002$; $E=0.0203$; $F=-1.0819$; $G=156.82$;

h) on the shroud, β ; $A=0$; $B=0$; $C=3E-07$; $D=-1E-04$; $E=0.0101$; $F=-0.7587$; $G=175$.

2. A multi-stage electric pump unit, in accordance with the preceding claim, characterised because on the impeller:

a1) on the hub, the vaneless zone; $A=0$; $B=0$; $C=0$; $D=6E-05$; $E=0.0014$; $F=-0.0146$; $G=27.511$;

b1) on the shroud, the vaneless zone; $A=0$; $B=0$; $C=0$; $D=0$; $E=0$;
 $F=0$; $G=64.5$;

c1) on the hub, the vaned zone; $A=0$; $B=0$; $C=5E-06$; $D=-0.0014$;
 $E=0.1535$; $F=-6.3821$; $G=121.24$;

5 d1) on the shroud, the vaned zone; $A=-4E-08$; $B=8E-06$; $C=-$
 0.0006 ; $D=0.0247$; $E=-0.04771$; $F=4.3023$; $G=50.015$;

e1) on the hub, β ; $A=0$; $B=3E-09$; $C=-9E-07$; $D=0.0001$; $E=-$
 0.0042 ; $F=-0.0915$; $G=34.402$;

f1) on the shroud, β ; $A=0$; $B=1E-09$; $C=-5E-07$; $D=6E-05$; $E=-$
10 0.0044 ; $F=0.1822$; $G=22.2$.

3. A multi-stage electric pump unit, in accordance with the first
claim, characterised because on the impeller:

a2) on the hub, the vaneless zone; $A=0$; $B=0$; $C=0$; $D=5E-05$;
 $E=0.0013$; $F=-0.0139$; $G=27.511$

15 b2) on the shroud, the vaneless zone; $A=0$; $B=0$; $C=0$; $D=0$; $E=0$;
 $F=0$; $G=64.5$

c2) on the hub, the vaned zone; $A=0$; $B=0$; $C=5E-06$; $D=-0.0012$;
 $E=0.1205$; $F=-4.7599$; $G=93.614$

d2) on the shroud, the vaned zone; $A=0$; $B=7E-07$; $C=-0.0001$;
20 $D=0.0058$; $E=-0.113$; $F=0.8709$; $G=62.273$

e2) on the hub, β ; $A=0$; $B=0$; $C=9E-08$; $D=-3E-05$; $E=0.0002$; $F=$
 0.0246 ; $G=41.062$

f2) on the shroud, β ; $A=0$; $B=0$; $C=-6E-07$; $D=0.0001$; $E=-0.0126$;
 $F=0.5887$; $G=23.694$.

S U M M A R Y

A multi-stage electric pump unit, of those that consist of a multi-stage centrifugal pump with an electric motor coupled directly to the pump, where each stage consists of a pump, an impeller and a diffuser, which each have channels
5 with vaned and vaneless zones. These zones are delimited by a shroud-surface and a hub-surface, where the β angle is the angle of the tangent at each point, characterised because, given that the Y-axis of the electric pump is the radial co-ordinate and X is the axial co-ordinate, for flow rates, Q, between 2500 and 8000 litres/minute, the points of the impeller and diffuser surface comply with the sixth degree polynomial
10 equation, $Y = f(x) = Ax^6 + Bx^5 + Cx^4 + Dx^3 + Ex^2 + Fx + G$, and changing the constants of the equation for each part-zone of the diffuser and impeller.

Applicable to hydraulic machines.

15 REF.: FIG. 6